UNIT ONE

THERMAL ENERGY AND CHANGES IN MATTER

Physical changes... do not involve breaking or forming new bonds (e.g., changes of state and dissolving).

LESSON ONE: PHYSICAL CHANGES

STATES OF MATTER CHANGES

Endothermic Processes (Heating)

Melting — Evaporation — Sublimation

Sublimation

Exothermic Processes (Cooling)

Condensation

Freezing

HEAT OF SOLUTION

The amount of heat absorbed or released when a known amount of solute dissolves in a given volume of solvent to form a solution.

Endothermic Solution

Absorbs heat from the environment.
Solution temperature decreases ($T_2 < T_1$).

Compress

1. Potassium Sulfate
2. Ammonium Nitrate
3. Ammonium Chloride
4. Copper Sulfate ($CuSO_4$)
5. Cobalt Chloride ($CoCl_2$)
6. Potassium Iodide

Exothermic Solution

Releases heat to the environment.
Solution temperature increases ($T_2 > T_1$).

Compress

1. Sodium Hydroxide
2. Potassium Hydroxide
3. Concentrated Sulfuric Acid
4. Sodium Carbonate
5. Calcium Chloride
6. Lithium Chloride

HYDRATED (WATER-CONTAINING) MATERIALS

Materials formed when material molecules are bonded with a specific number of water molecules.

Heating ⇄ removal

Hydrated Copper Sulfate (Blue in color) — Anhydrous: (White in color)

Heating ⇄ removal

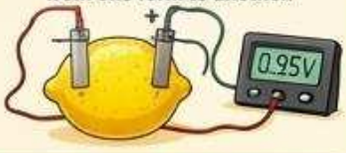
Hydrated Cobalt Chloride (Pink in color) — Anhydrous: (Blue in color)

(The process is reversible by adding water, and it is exothermic).

LESSON TWO: CHEMICAL CHANGES

LAW OF CONSERVATION OF ENERGY

Energy is neither created nor destroyed, but can only be converted from one form to another.



IMPORTANT LIFE APPLICATIONS

Thermite (Highly Exothermic): Melting iron for welding railway tracks.

Self-Heating quicklime which reacts with water to produce slaked lime and heat.

Lemon Battery

Thermite Reaction
(Higting iron for welding railway tracks.

$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe + heat$

Self-Heating Containers
Contain quicklime which reacts with water to produce slaked lime and heat.

COMPARISON OF CHEMICAL REACTIONS

Endothermic Reactions		Exothermic Reactions
Bond Breaking Energy > Bond Formation Energy		Bond Formation Energy > Bond Breaking Energy
Medium Temperature Decreases		Medium Temperature Increases
Reactants + Heat → Products		Reactants → Products + Heat
1. Limestone decomposition 2. Ozone dissociation 3. Sodium bicarbonate and HCl		1. Neutralization 2. Acid-Alkali neutralization 3. Magnesium and HCl 3. Fuel combustion

BOND ENERGY

Bond Breaking (Reactants): Endothermic process

Bond Formation (Products): Exothermic process

LESSON THREE: COMBUSTION, OXIDATION, AND REDUCTION

COMBUSTION TRIANGLE

For combustion to occur, 3 elements must be present: (Fuel + Oxygen + Heat).

TYPES OF FUELS

Fossil Fuel	Biofuel	Synthetic Fuel
Coal, Petroleum, Natural Gas - Most used / Non-renewable	Ethyl Alcohol - Renewable, derived from starch-rich plants	Hydrogen - Fuel of the future - non-polluting and high calorific value

COMBUSTION PRODUCTS

Complete Combustion (Abundance of O_2)

$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O + Heat$

Incomplete Combustion (Limited amount of O_2)

$4NH_3 + 3O_2 \xrightarrow{\Delta} 2N_2 + 6H_2O + Heat$

FIRE EXTINCTION

The idos depends on:
- Breaking one side of the combustion triangle (e.g., isolating from oxygen).

Petroleum and Sodium Fires
Use Sand (Do not use water because petroleum floats on it, and sodium reacts violently with it).

OXIDATION AND REDUCTION

Equation as focus:

$CuO + H_2 \rightarrow Cu + H_2O$

(H_2) (CuO)

Oxidation	Reduction
Increase in oxygen or decrease in hydrogen. (Happened to H_2)	Decrease in oxygen or increase in hydrogen. (Happened to CuO)
Oxidizing Agent The substance that gives oxygen (CuO).	**Reducing Agent** The substance that extracts oxygen (H_2).

REFINED LEARNING SERIES

UNIT ONE REVIEW SUCCESSFULLY COMPLETED!

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UNIT 2: FORCES AND MOTION

LESSON 1: NEWTON'S LAWS OF MOTION

PHYSICAL QUANTITIES AND FORCE

SCALAR QUANTITIES

Defined by magnitude only.

Has Magnitude (✓)

No Direction (✗)

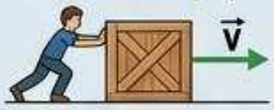
Examples: Mass, Time

VECTOR QUANTITIES

Defined by magnitude and direction.

Has Magnitude (✓)

Has Direction (✓)



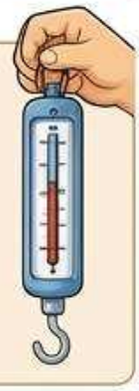
Examples: Force, Acceleration

FORCE

An external agent that changes or attempts to change the body's state of motion.

Measured in Newtons (N).

Measured with a spring scale.



BALANCED AND UNBALANCED FORCES

BALANCED FORCES

Balanced Forces

Resultant = Zero.

(A stationary body remains stationary, and a moving body remains moving at a constant speed).

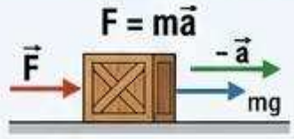
UNBALANCED FORCES

Unbalanced Forces

Resultant ≠ Zero.

(The state of motion of the body changes, and it acquires acceleration).

NEWTON'S THREE LAWS

Law	Concept / Text	Applications
Law 1: Inertia	Concepts: passenger leaning back or user, passinging car car in stopping.	Stopping Seatbelt Tablecloth
Law 2: Acceleration	Concepts main some as lean as the crate, area vector, vectors different magnituded.	 $F = m\vec{a}$ $\vec{F}$ $-\vec{a}$ mg
Law 3: Action and Reaction	Concepts action and action neaction in rocket, forward and backward Reaction.	Forward Flyboard Drone

LESSON 2: SIMPLE MACHINES & LEVERS

Machine: An external agent that changes or attempts attfont changes/rnognittions and machine.

Lever: A machine contarines a lever that detsives a meating body, when sealing or moving at a constant speed.

THE LAW OF LEVERS

Effort × Effort Arm = Load × Load Arm

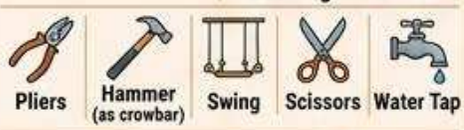
Effort Torque	Load Torque
F_R = Load	L_{aa} = Load

CLASS 1 LEVERS

Fulcrum/Effort/Load Location

Saves Effort? ✓ / ✗

Mechanical Advantage ✓ / ✗



Pliers | Hammer (as crowbar) | Swing | Scissors | Water Tap

Wheelbarrow | Bottle Opener | Nutcracker

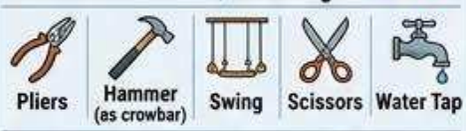
Head and Neck | Foot and Leg | Arm (Elbow)

CLASS 2 LEVERS

Fulcrum/Effort/Load Location

Saves Effort? ✓ / ✗

Mechanical Advantage ✓ / ✗



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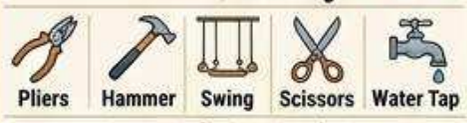
CLASS 3 LEVERS

Fulcrum/Effort/Load Location

Saves Effort? ✓ / ✗

Mechanical Advantage ✓ / ✗



Pliers | Hammer | Swing | Scissors | Water Tap

Ice Tongs | Hand Broom | Fishing Rod | Tweezers

WHY DO WE USE THIRD-CLASS LEVERS DESPITE NOT SAVING EFFORT?

For other important tasks like: **increasing speed, performing precise work, or avoiding hazards.**

UNIT 2 SUCCESSFULLY COMPLETED!

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UNIT THREE:

REPRODUCTION IN LIVING ORGANISMS

EDUCATIONAL OVERVIEW

1 TYPES OF CELLS IN LIVING ORGANISMS

SOMATIC CELLS

(Diploid 2n) : Division: Mitosis

Genetic Material: Complete

Examples: Liver, Intestines, Skin, muscle tissue, leaf (part of a plant)

REPRODUCTIVE CELLS (GONADS)

(Diploid 2n) : Division: Meiosis

Genetic Material: Complete

Examples: Plant stamen, anther (plant part)

GAMETES (SEX CELLS)

(Haploid n) : Division: Non-dividing

Genetic Material: Half

Examples: Pollen grain

SECTION 2 | COMPARISON OF CELL DIVISION

MITOTIC DIVISION (ASEXUAL)

- Occurs in somatic cells
- Produces 2 identical cells
- Daughter cells have Diploid (2n) count
- Preserves genetic stability (clone)

MEIOTIC DIVISION (SEXUAL)

- Occurs in reproductive cells
- Produces 4 varied cells (gametes)
- Daughter cells have Haploid (n) count
- Achieves genetic variation (due to crossing over)

IMPORTANT NOTES

- Zygote (male n + female n ⟶ 2n, mitotic division for embryo) + continuous noon-·mitosis.
- Cancer Tumor: cluster of cells from continuous abnormal mitosis.

LESSON TWO | REPRODUCTION IN FLOWERING PLANTS

Plant definition: Flower: A short modified shoot Bract: Leaf from which the axil axil anit

1. FLORAL WHORLS (FROM OUTER TO INNER)

Whorl Name	Leaf Name (with color)	Essential Function
Calyx		Protect inner parts
Corolla		Attracts insects
Androecium		Produce pollen grains
Gynoecium		Produce ovules

2. TYPES OF INFLORESCENCE (FLOWER CLUSTERS)

Simple Raceme

Simple Umbel

3. POLLINATION, FERTILIZATION, & FRUIT FORMATION

Attracts insects, scented, sticky pollen

Wind and crounds: Exposed anthers, feathery stigmas, lightweight pollen

Ovary ⟶ FRUIT

Ovule ⟶ SEED

4. AFTER FERTILIZATION (Fusion of Pollen Grain & Ovule)

Ovary ⟶ FRUIT

Ovule ⟶ SEED

Single ⟶ Multiple seed fruits

5. POST-REPRODUCTIVE FLORAL PARTS REMAINING ON FRUIT

Calyx remains: Tomato

Corolla remains:

Pumpkin STAMENS

Stamens and Calyx remain:

LIFE APPLICATIONS (MEDICAL USES OF FLOWERS)

LAVENDER
Calming, muscle pain relief

CHAMOMILE
Treats stomach problems

HIBISCUS
Lowers high blood pressure

UNIT THREE REVIEW SUCCESSFULLY COMPLETED!

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UNIT FOUR:
PHYSICAL CHANGES IN THE ATMOSPHERE

1 Weather and Climate

WEATHER
DEFINITION: Condition of the atmosphere in a specific location over a short period of time.

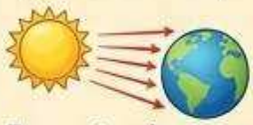
EXAMPLE:
The weather is hot and humid today over Cairo.

CLIMATE
DEFINITION: Condition of the atmosphere in a specific location over a long period of time.

EXAMPLE:
The Mediterranean climate is hot and dry in summer and warm and rainy in winter.

KEY THERMAL LAWS
1. **DAILY TEMPERATURE RANGE =**
(Maximum Temperature − Minimum Temperature)
2. **MEAN DAILY TEMPERATURE =**
$$= \frac{(\text{Maximum} + \text{Minimum})}{2}$$

2 Factors Affecting Temperature (Key Elements of Climate)

Angle of Incidence (Circles of Latitude)


Temperature decreases the further we are from the Equator (Vertical rays are more intense than slanted rays).

Altitude (from Sea Level)

Temperature decreases as altitude increases (Why snow forms on mountain tops).

Specific Heat (Effect of water bodies)

The specific heat of water is greater than land (Water heats up and cools down slowly).

Sea Breeze

Occurs during the day (cool air moves from sea to land).

Land Breeze

Occurs at night (cool air moves from land to sea).

3 Atmospheric Pressure and Humidity

ATMOSPHERIC PRESSURE
DEFINITION: The weight of a column of air of standard cross-sectional area (1 cm²) and the standard height of the atmospheric boundary layer (Standard at sea level ≈ 1013.25 mb). Measured with a barometer.

ABSOLUTE HUMIDITY
DEFINITION: The actual mass of water vapor in a specific volume of air (g/m³).

RELATIVE HUMIDITY
$$\text{Relative Humidity} = \frac{\text{Absolute Humidity}}{\text{Maximum Capacity}} \times 100\%$$

FACTORS AFFECTING ATMOSPHERIC PRESSURE (Inverse Relationship)

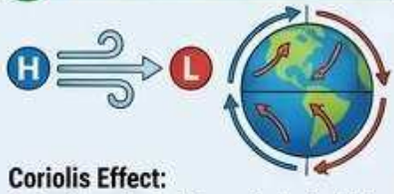
Humidity
Density of water vapor is less than dry air.

Temperature
(Hot air expands, its density decreases and it rises).

Altitude
(Weight of air column decreases)

LESSON TWO: Wind Movement and Forecasting

1 Wind Movement and Coriolis Effect



Coriolis Effect:
Deflection of winds from their straight path due to Earth's rotation on its axis.

- Deflects to the right in the Northern Hemisphere.
- Deflects to the left in the Southern Hemisphere.

The effect disappears at the Equator and is maximum at the poles.

2 Atmospheric Pressure Areas (Key Comparison)

	HIGH PRESSURE (H) (Blue)	LOW PRESSURE (L) (Red)
PRESSURE		
AIR MOVEMENT		
WEATHER		
CLIMATE EXAMPLES		

3 Weather Forecasting Tools and Maps

SYNOPTIC WEATHER MAPS

...points of equal atmospheric pressure (isobars).

RADIOSONDES

... helium or hydrogen
... rise upwards...
... explodes...
... increases volume...

STEVENSON SCREEN

- ☑ White paint
- ☑ Slatted openings
- ☑ Raised 120 cm
- ☑ Away from obstructions
- ☑ Accuracy

IMPORTANT NOTE
Weather forecasts are possibilities, not facts (influenced by many variables). Accuracy decreases over longer periods.

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VICTORY ACHIEVED!
(A professional secular message)

UNIT FOUR SUMMARY
- Atmosphere physics, and foreaaways
- Key factors on climate
- Key factors, wind patterns
- wind patterns, forecasting tools

D.M.RAZK موقع الدكتور محمد رزق معلم الكيمياء التعليمي

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